

# **Mechanisms of Particulate Toxicity: Findings of the Three Campus Study**

**July 22, 2004**



**California Air Resources Board**

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**California Environmental Protection Agency**

# Background

- ◆ Ambient particulate matter (PM) has been associated with adverse health effects
  - New California standards for PM
- ◆ Biological mechanisms are largely unknown
- ◆ Three interrelated studies investigated possible mechanisms for PM adverse health effects
  - UC Davis, UC Irvine, and UCSF

# Study Design

## ◆ Subjects/Models

- UC Davis: rat model of allergic airway disease
- UC Irvine: rat model of elderly humans
- UCSF: asthmatic adults

## ◆ Exposure Conditions

- 4-6 hour exposures on single or multiple days
- ~250  $\mu\text{g}/\text{m}^3$  PM (ammonium nitrate & elemental carbon)
- PM plus 0.2 ppm ozone ( $\text{O}_3$ )

## ◆ Endpoints

- Airway inflammation & lung function
- Heart rate, blood pressure & heart rate variability

# Key Findings

## UC Davis (allergic rats)

- ◆ PM exposure did not enhance allergic airway inflammation
- ◆ PM exposure increased epithelial cell proliferation (lung damage)

## UC Irvine (elderly rats)

- ◆ Multi-day PM exposure decreased blood pressure and heart rate variability
- ◆ No cardiovascular responses from single day exposures

# Key Findings (cont'd)

## UCSF (asthmatic adults)

- ◆ Airway inflammatory changes confined to PM plus O<sub>3</sub> exposures
- ◆ 4-hour exposure to PM alone induced a small decrease in lung function
- ◆ Exposure to PM plus O<sub>3</sub>, was associated with significant changes in heart rate variability

# Conclusions

Particulate matter (ammonium nitrate plus elemental carbon) induces adverse effects in:

- ◆ Animal model of allergic airway disease
- ◆ Animal model of the elderly
- ◆ Asthmatic humans exposed to PM plus  $O_3$

Results support link between PM and adverse health effects

